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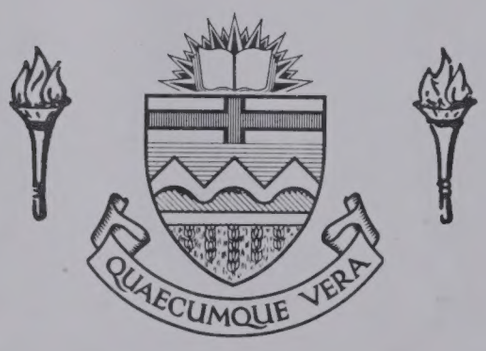

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THE EFFECT OF MEANINGFULNESS ON TRANSFER OF LEARNING IN RETARDED PUPILS

by

© LUAN SOOKBANG

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Effect of Meaningfulness on Transfer of Learning in Retarded Pupils" submitted by Luan Sookbang in partial fulfillment of the requirements for the degree of Master of Education.

ABSTRACT

In this experimental investigation an attempt was made to study transfer of learning from serial to paired-associate tasks having different levels of meaningfulness. The subjects were 42 boys and 42 girls enrolled in the senior opportunity classrooms of McKay Avenue Public School, Edmonton, Alberta. Two experiments were included in the present study.

Experiment I consisted of three subgroups of seven boys and seven girls each, and was designed to: (1) investigate transfer from a high meaningfulness serial task to a high meaningfulness paired-associate task (H-H transfer condition), (2) investigate transfer from a low meaningfulness serial task to a high meaningfulness paired-associate task (L-H transfer condition), and (3) compare the difference between the transfer in the H-H transfer condition and the transfer in the L-H transfer condition.

Experiment II also consisted of three subgroups of seven boys and seven girls each, and was designed to examine: (1) transfer from a low meaningfulness serial task to a low meaningfulness paired-associate task (L-L transfer condition), (2) transfer from a high meaningfulness serial task to a low meaningfulness paired-associate task (H-L transfer condition), and (3) the difference between transfer in the L-L and H-L transfer conditions.

The results of Experiment I and Experiment II were combined to compare: (1) the difference between the combination of transfers in the H-H and L-L transfer conditions and the combination of

transfers in the L-H and H-L transfer conditions, and (2) the difference between the combination of transfers in the L-L and L-H transfer conditions and the combination of transfers in the H-H and H-L transfer conditions.

The experimental groups of Experiment I and Experiment II learned the serial tasks first and then the paired-associate tasks. The control groups learned the paired-associate tasks only. Mean number of trials was used as the criterion measure for statistical analysis. The t test was used to test the differences in transfer among the treatment groups.

The overall results of the present study did not provide any support for the hypotheses centering on the two notions that: (1) a prior learning task with low meaningfulness is more effective on a transfer task than is a prior learning task with high meaningfulness on the same transfer task, and (2) the combination of transfer of learning between tasks of similar level of meaningfulness is greater than the combination of transfer of learning between tasks of dissimilar levels of meaningfulness.

Suggestions and refinements for further research and possible practical applications of the findings were discussed.

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CHAPTER I

THE PROBLEM

General Problem

Prior to the twentieth century, educational views of transfer of learning were influenced by the notion of "formal" disciplines (Deese & Hulse, 1967). Educational practices reflected the belief that the study of Greek, rhetoric, geometry, and Latin "exercised" the mind. One of the most influential of the early educational psychologists, E.L. Thorndike, studied the transfer value of Latin. Using a criterion of reading achievement, Thorndike found a negligible facilitative effect of prior Latin instruction (Thorndike, 1923). Other studies also suggested the limited transfer of Latin (Cole, 1924; Thorndike & Ruger, 1923). As an indication of the continuing relevance of the study of transfer, Deese has stated:

> There is no more important topic in the whole of the psychology of learning than transfer of training. Nearly everyone knows that transfer of learning is basic to educational theory. Practically all educational and training programs are built upon the fundamental premise that human beings have the ability to transfer what they have learned from one situation to another (1958, p. 213).

Relevant literature includes study of transfer of learning in diverse aspects of school learning and many of these studies have addressed themselves to questions of transfer among various subjects in formal academic curricula.

Transfer of learning from one situation to another can be positive, negative or indeterminate, depending on many factors. One

factor may be meaningfulness, or association value of the elements of the two learning tasks. It has been suggested (McGeoch, 1930; Underwood & Schulz, 1960, p. 35) that meaningfulness is an indication of difficulty of a learning task. Thus, the task is considered easy if it consists of the elements that have high meaningfulness. Meaningfulness appears to play an important role in determining the direction and amount of transfer of learning. Noble (1961) has proposed that meaningfulness increases learning rate, but that it may not affect transfer of learning.

Some studies on transfer from serial to paired-associate learning using normal subjects (Ss), as is indicated in Chapter II of the present study, have suggested that interitem associations formed in serial learning, practice effect, "warm-up," and "learning-to-learn" may be important factors determining the amount and direction of transfer from serial to paired-associate learning (Horowitz & Izawa, 1963; Postman & Stark, 1967; Schwenn & Postman, 1967; Thune, 1951). Postman, Keppel and Zacks (1968) found that meaningfulness, in relation to learning-to-learn and practice effect, plays a vital part in transfer between two paired-associate tasks.

The present writer could not find in the literature any study on transfer from serial to paired-associate learning, as a function of meaningfulness, that has been done with the educable mentally retarded (EMR) children. The problem of meaningfulness in relationship to the transfer from serial to paired-associate learning needs to be investigated. The most effective order of presentation of materials

with different levels of meaningfulness would appear to be a critical question in the problem of inducing learning in mentally retarded children. Therefore, the purpose of the present study, using EMR subjects, was to examine the direction and amount of transfer, and the differences in transfer from serial to paired-associate tasks having different levels of meaningfulness.

The writer undertook the present investigation in the hope that the present study might shed light on some aspects of transfer of learning in the mentally retarded. In addition, he hoped that the results of this study might yield some clues for the curriculum makers and teachers of the EMR children with respect to appropriate presentation of subject-matter according to level of difficulty.

CHAPTER II

REVIEW OF RELATED LITERATURE

Meaningfulness and Paired-associate Learning

Numerous studies suggest that meaningfulness plays an important role in paired-associate learning in both normal and mentally retarded Ss. For example, Noble and McNeely (1957) examined the role of meaningfulness in paired-associate learning, using stimulus and response words of different levels of meaningfulness. Their Ss were 62 male and 28 female university students divided into three levels of ability as assessed by performance on a pre-experimental practice list. Noble and McNeely found that their "slow-learning" Ss learned more efficiently with increases in meaningfulness.

From his review of studies, Lipman (in Ellis, 1963) has concluded as follows: "Quite obviously, the difficulty (meaningfulness) dimension is an important parameter of the IQ-paired associate learning relationship. The more difficult the task, the greater the performance deficit becomes in the retarded [p. 395]."

Hom (1967) investigated the effects of association strength and retention intervals on paired-associate acquisition, with 30 male retardates whose MAs ranged from 5.6 to 9.8 years, and whose CAs ranged from 26 to 32 years. The analysis of variance for trials to criterion showed a significant difference for the retention intervals, association strength, and the interaction between associative strength and retention intervals.

The effects of association value of paired-associate words on the associative learning performance of 48 mentally retarded and 48 non-retarded Ss enrolled in junior and senior high school classes were examined by Drew, Prehm & Logan (1968). Data analysis revealed that both subject-groups reached criterion in significantly fewer trials on high association value pairs than low association value pairs, and non-retarded Ss required significantly fewer trials to reach criterion than retardates on both high association value and low association value pairs.

Prehm (1966a) compared the short and long-term retention performance of 96 educable mentally retarded (EMR) children with that of regular class normal children at upper primary, intermediate, and junior high school levels. Two levels of meaningfulness, task difficulty, and degree of original learning were measured. It appeared that the relearning performance of the normal Ss was significantly superior to that of the EMR Ss on both 24 hour and 3 month tests of retention.

Prehm (1966b) examined paired-associate learning performance as a function of two levels of meaningfulness and two levels of difficulty with 96 EMR Ss and 96 regular class normal Ss from upper primary, intermediate, and junior high school classes. The results suggested that: (1) the performance of the normal Ss was significantly superior to that of the EMR Ss; (2) at the high difficulty level, the meaningful paired-associate tasks were learned by the normal Ss with significantly fewer trials than the nonsense paired-associate tasks; (3) variations in performance of the retarded Ss

as a function of meaningfulness were non-significant; and (4) a significantly higher number of trials was required to reach the learning criterion on the high difficulty task than on the low difficulty task.

In Lance's study (1965), 64 adolescent EMR Ss and 64 normal Ss of the same CA were presented with a verbal paired-associate task. Two levels of training, and nonsense syllables of high and low levels of meaningfulness were used in this study. Results revealed that the EMR Ss required significantly more trials than normals to reach the learning criterion with materials of both levels of meaningfulness.

Thomason (1967) investigated the effect of meaningfulness and the difference in learning rate between 32 elementary school boys and girls and 32 mentally retarded boys and girls on a paired-associate learning task which employed non-word CVC trigrams, scaled for meaningfulness for both stimulus and response. The findings indicated that the mentally retarded and normal children differed significantly, in favor of the normal Ss, with respect to learning rate on a paired-associate learning task as measured by trials to criterion.

In Johnson and Blake's study (1960), four groups of 15 Ss (normal experimental group, normal control group, EMR experimental group, and EMR control group) were matched on a mean MA of 10-0 years. A paired-associates list of three pairs of low association value nonsense syllables was presented to the EMR and the normal Ss. In

terms of correct responses, the normal Ss learned the paired-associates task significantly better than did the EMR Ss.

In summary, the studies mentioned in this review present evidence that high meaningfulness is related to learning rate, trials to criterion, and retention on paired-associates learning. Furthermore, it is suggested that the learning performance, with respect to both trials to criterion and retention, of the normal Ss on the paired-associates task having different levels of meaningfulness is significantly better than that of comparable mentally retarded Ss. A possible reason for this is that the implicit associative responses are less spontaneously formed by the mentally retarded Ss than by the normal Ss (Wallace & Underwood, 1964). It can be also assumed that implicit associative responses are more strongly available in the high association value paired-associates than the low association value paired-associates (Wallace & Underwood, 1964).

Transfer from Serial to Paired-associate Learning

Several studies suggest that interitem associations occurring during serial learning may be an important factor in determining the direction and amount of transfer from serial to paired-associate learning.

Horowitz and Izawa (1963) compared serial learning with paired-associate learning. Eighty students of the introductory psychology classes at Stanford University participated in the study. The results of the study indicated that the amount of transfer from serial to paired-associate learning was greater than the amount of transfer

from paired-associate to serial learning when the internal interference in the serial list was minimized. That is, the serial list consisted of words which were not associates of one another.

Crowder, Chisholm and Fell (1966) investigated transfer from serial to continuous paired-associate learning with 36 Yale University undergraduates. The Ss first learned a serial list of 18 words and then were tested on a paired-associate list involving short-term retention of presented paired-associate pairs. They found that recall of the paired-associate task constructed from adjacent serial items was better than recall of the paired-associate task consisting of irrelevant items.

Crowder (1968) did a similar study with five groups of 12 Yale University undergraduates. Two levels of transfer (continuous paired-associate pairs of items from adjacent serial list positions vs. continuous paired-associate pairs of items from remote serial list positions), and three levels of serial learning trials (0, 4, and 12 trials on the relevant serial list) were used. Facilitation was evident in the transfer of adjacent associations from serial to short-term retention of once presented paired-associates, and inhibition in the transfer of remote associations. Both effects were enhanced by longer serial learning trials.

Postman and Stark (1967) investigated the interitem associations formed in serial learning, the effect of knowledge about relationship between the prior serial list and the transfer task, and the effect of practice on transfer from serial to paired-associate learning.

They found that: (1) there was a significant positive transfer from serial to paired-associate list derived from the adjacent items of the prior serial list, and a significant amount of negative transfer from serial to paired-associate list constructed from the non-adjacent members of the serial lists; (2) knowledge of relationships between the serial list and paired-associate list enhanced positive transfer, but failed to affect negative transfer; and (3) positive transfer increased and negative transfer decreased as a function of practice.

In Shuell and Keppel's study (1967), the effects of the associative strength occurring during serial learning, and the varied and the constant method of serial list presentation on transfer from serial to paired-associate learning was examined. Results indicated that the associative strength formed between contiguous items in the serial list was the critical factor producing the positive transfer observed on the paired-associate list, and that the varied serial list presentation group gave significantly more correct responses on the paired-associate learning than did the constant serial list presentation group.

Stark (1968) investigated the effects of word frequency and stimulus pronunciation on transfer from a serial list to a paired-associates list consisting of adjacent items of the prior serial list. He found that there was highly significant transfer observed on the paired-associates list as measured by trials to criterion, and that neither word frequency nor stimulus pronunciation had significant effects on transfer from serial to paired-associate learning.

Some studies suggest that interitem associations occurring during serial learning inhibit, rather than facilitate, learning performance on a paired-associate task derived from adjacent items of the prior serial list. Primoff (1938) used 16 undergraduate university students to investigate the effects of interitem associations formed in learning a serial list on transfer from the serial list to a paired-associate list constructed from adjacent items of the serial list. He found that the interitem associations impaired the performance of paired-associate learning. A possible explanation for the results of this study is that backward association largely occurred while the Ss were learning the paired-associate list. Other possible explanations are that the paired-associate task may have introduced interference due to intralist similarity of the stimuli and responses, and that this study employed a small number of Ss.

Umemoto and Hilgard (1961) examined the effect of similarity between stimulus and response items within the list on paired-associate learning. The results suggested that the more similarity among stimulus and response items within the paired-associate list, the more trials required to master the paired-associate task.

Young (1961) reported a similar study with 72 students in introductory psychology classes at the University of Texas. He found that rate of learning was directly related to meaningfulness of paired-associate words, but inversely related to the degree of stimulus-response similarity.

In another study, Young (1959) compared two methods of learning serial associations with 68 undergraduate students. His purpose was to replicate Primoff's study (1938), and to test the hypothesis that backward associations do not retard serial learning, but that the same backward associations do inhibit paired-associate learning. The experimental design of Primoff's study was refined by having two experimental groups. One group (Group S-P) learned a serial list first and then a paired-associate list constructed from adjacent items of the serial list by Primoff's method. The other group (Group P-S) learned a paired-associate list first and then a serial list. Results showed that the transfer from serial to paired-associate learning was negligible, whereas the transfer from paired-associate to serial learning was considerable.

Young and Casey (1964) examined transfer from serial to paired-associate learning, using 48 undergraduate Ss at the University of Texas. They wished to test the proposition that the results of the study by Horowitz and Izawa (1963) might have been produced by differential practice, not interitem associations formed during serial learning. The items used in the serial list and paired-associate list were taken from the first 20 items of condition I of the Horowitz and Izawa study. One of the two groups of Ss learned a serial list and then the paired-associate list derived from adjacent items of the serial list. The other group learned another irrelevant serial list and then learned the paired-associate list administered to the first group. They found that there was no significant difference between

the two groups, using the measure of trials to criterion, on the transfer task. The findings did not support the theory of interitem associations, but they did replicate the results of previous investigations of transfer from serial to paired-associate learning (Young, 1961, 1962). The results also suggested that the positive transfer observed in the Horowitz and Izawa study may have been produced by practice effects.

Jensen and Rohwer (1965) investigated the effects of positional associations and sequential associations on the subsequent learning of a paired-associate task composed of stimulus-response connections existing in a prior serial list. The results revealed that: (1) there was no significant overall transfer from serial to paired-associate learning, in terms of total trials to criterion, for either the positional or sequential conditions; (2) there was significant transfer under both conditions only in one-third of the trials to criterion; and (3) the percentage of transfer was significantly related to serial positions (i.e., those items at the beginning and at the end of the serial list showed positive transfer, and those in the middle showed zero or negative transfer).

Martin and Greene (1966) examined the effects of interitem associations on transfer from serial to paired-associate learning with 20 undergraduates in an introductory psychology course. Two serial lists of 10 CVC trigrams and two paired-associate lists of nine pairs were used. In the experimental conditions, S learned a paired-associate list constructed from adjacent items of a previously learned serial list; but in the control condition, an irrelevant paired-

associate list was learned. The results showed no differences in trials to learn the two paired-associates lists. This study employed a small number of Ss in each group (N=10). Therefore, the results of the study, as supportive of the theory of interitem associations, must be viewed with caution.

Rate of paired-associate presentation may be a factor influencing transfer from serial to paired-associate learning other than the item associations and differential practice effect. In the study of Heaps, Greene, and Cheney (1968), the effect of paired-associate presentation rate on transfer from serial to paired-associate learning was studied with 80 undergraduates at Eastern Washington State College. The results indicated positive transfer from serial to paired-associate learning, but this effect was limited to the longer paired-associate presentation rate.

Erickson, Ingram, and Young (1963) examined the effects of rate of paired-associate presentation on transfer from serial to paired-associate learning with 48 undergraduate university students. They found that there were no significant differences in transfer under different rates of paired-associate presentation, even though the rate of learning a paired-associate task is related to the paired-associate presentation rate. The different results between the Erickson, et al and the Heaps, et al studies may be accounted for in a number of ways. For example, it is possible that: (1) the Heaps, Greene, and Cheney study used a longer paired-associate rate (6:6 seconds) than the rate of paired-associate presentation of Erickson, Ingram,and Young (4;4 seconds); (2) Erickson, Ingram, and Young's

study employed a longer serial list (14 serial items), whereas Heaps, Greene, and Cheney's list was shorter (10 serial items); and (3) the two studies used different tasks (lists of words).

Besides interitem associations, paired-associate presentation rates, and practice effect, progressive improvement in the performance on the transfer task is conventionally attributed to two types of non-specific transfer effects, viz., warm-up and learning-to-learn (Schwenn & Postman, 1967). Learning-to-learn refers to acquisition of instrumental habits which facilitate the mastery of new tasks, e.g., the development of successful techniques of mediation (Postman & Schwartz, 1964). Warm-up refers to the development of a set which maximizes S's efficiency in the performance of a rote learning task (Postman & Schwartz, 1964). An effective set presumably involves such factors as postural adjustment and the adoption of an optimal rhythm for observing stimuli and giving overt responses (Postman & Schwartz, 1964). Warm-up is a factor directly related to the practice effect. In verbal learning, warm-up is greater if the level of practice on the learning task is higher.

For example, Thune (1951) examined the relationship between level of practice and warm-up effect on the performance of paired-associate learning using 60 undergraduates at Vanderbilt University. Three different paired-associate lists were learned to the criterion of one perfect recitation on each of five days. The results of the study suggested that warm-up, in connection with the level of practice, yielded a significant effect on trials to criterion among the successive paired-associate lists. On each day, the last paired-

associate task resulted in successively fewer trials to criterion.

In addition to being related to level of practice, warm-up also appears to be related to learning-to-learn. These two associated factors are thought to affect learning performance on the transfer task. Schwenn and Postman (1967) examined the relative effectiveness of warm-up and learning-to-learn on rote learning performance with 80 undergraduates at the University of California. The results suggested that: (1) performance on the common transfer task was better after the learning-to-learn treatment than after control treatment; (2) the learning-to-learn group had significantly fewer trials to criterion on the transfer task than the control group; and (3) performance under the condition of learning-to-learn represented the combined effects of warm-up and learning-to-learn.

Some studies suggest that practice effect is related to meaningfulness of the elements of the prior learning task. For example, Postman, Keppel, and Zacks (1968) examined the practice effect on transfer of learning between two successive paired-associate tasks involving varied levels of meaningfulness of response words. The Ss were drawn from undergraduates at the University of California. The results remained consistent with the finding that training on low meaningfulness tasks is a more effective experimental treatment than training on high meaningfulness tasks.

Item similarity between two learning tasks is also related to the transfer of learning. McGeoch and Irion (1960) stated that several studies which followed the pioneer investigations of

Thorndike and Woodworth (1902) have corroborated and extended their conclusions that there is usually less transfer between tasks of different types than between tasks of the similar type.

In summary, the studies cited in this review present equivocal evidence on the determinants of transfer from serial to paired-associate learning. These determinants would appear to be such factors as interitem associations, practice effect, and paired-associate presentation rates. Possible reasons for these studies giving different results about determinants of transfer from serial to paired-associate learning are that: (1) backward associations occur more frequently in the situation where the paired-associate task follows the serial task, and may inhibit the learning performance on the transfer task (Primoff, 1938; Young, 1959); (2) instruction regarding relationships between the serial task and paired-associate task may reduce intralist interference or backward association in paired-associates list, and may produce positive transfer from serial to paired-associate learning (Postman & Stark, 1967; Stark, 1968); and (3) these studies employed different levels and types of task as well as different kinds of Ss. In consequence they have yielded different results.

In the area of transfer of learning that is not related to the transfer from serial to paired-associate learning, several studies suggest that the variables of degree of practice, warm-up provisions, and learning-to-learn experience on the prior task have a significant effect on the transfer task. There is also some

evidence to suggest that the prior low meaningfulness task training is more effective on the transfer task than the prior high meaningfulness task training.

However, the effect of meaningfulness, in relation to practice effect, warm-up, and learning-to-learn, on transfer from serial to paired-associate learning, needs to be clarified. Therefore, the present study was designed to examine the effect of meaningfulness in a situation requiring transfer from serial to paired-associate learning, using Ss drawn from senior opportunity classrooms.

Because the studies reported in the literature focus on normal Ss, and particularly on that select population, the undergraduate university students, the present investigator concluded that an examination of the question of the effects of levels of meaningfulness in serial to paired-associate learning on mentally retarded children should be undertaken.

CHAPTER III

DEFINITIONS, POSTULATES, AND HYPOTHESES

Definition

Serial learning. Serial learning is the procedure in learning a task consisting of a sequence of words. To illustrate, S is required to anticipate each stimulus word before it appears in the window of the memory drum. At first he is to anticipate the first word. When the S sees the first word, he is to anticipate the second word. The same procedure is used until he sees the word before last and he is to anticipate the last word. The learning criterion is reached when the S can anticipate one complete series of responses without error. The serial learning score of each S is measured by number of trials to criterion (see Appendix C).

Paired-associate learning. Paired-associate (PA) learning is the procedure in learning a task that consists of a number of pairs of stimuli and responses. To illustrate, each pair consists of a stimulus item and a response item (see Appendix A). When the S sees a stimulus item appear alone in the window of the memory drum, he is required to anticipate the response item that is paired with that stimulus item. The learning criterion is reached when the S can anticipate a complete series of responses without error. The PA learning score of each S is measured in terms of the number of trials to criterion (see Appendix C).

Transfer of learning. Transfer of learning is the effect of learning an original task on the learning of a succeeding task

(McGeoch & Irion, 1952). For the present study, transfer of learning is operationally defined as the effect of learning an original serial task on the learning of a succeeding paired-associate task. The amount of transfer of learning is measured by subtracting the mean number of trials to criterion in learning a paired-associate task of the control group from the mean number of trials to criterion in learning the same PA task of the experimental group.

Positive transfer of learning. Positive transfer of learning is the facilitative effect of learning an original task on the learning of a succeeding task (McGeoch & Irion, 1952). Operationally, positive transfer of learning, as defined in this study, is the facilitative effect of learning an original serial task on a succeeding PA task. Transfer is considered positive if the mean number of trials to criterion in learning a PA task of an experimental group is less than the mean number of trials to criterion in learning the same PA task of the control group.

Negative transfer of learning. Negative transfer of learning is the interference effect of learning an original task on the learning of a succeeding task (McGeoch & Irion, 1952). For the present study, negative transfer of learning is operationally defined as the interference effect of learning an original serial task on the learning of a succeeding PA task. Transfer is negative if the mean number of trials to criterion in learning a PA task of an experimental group is greater than the mean number of trials in learning the same PA

task of the control group.

High meaningfulness words. In the present study, high meaningfulness words are words that are randomly selected from the monosyllabic words of nouns, adjectives, verbs, pronouns, and miscellaneous words which were included in Entwisle's study (1966) and classified as the words that occur more than 1000 times in Thorndike-Lorge J-count.

Low meaningfulness words. In the present study, low meaningfulness words are also words that are randomly selected from monosyllabic nouns, adjectives, verbs, pronouns, and miscellaneous words included in Entwisle's study (1966) and were classified as the words that occur less than 500 times in Thorndike-Lorge J-count.

Postulates

A low meaningfulness task requires greater number of trials to reach the learning criterion than does a high meaningfulness task (Braun & Heyman, 1958). A number of the studies reviewed in Chapter II of this investigation suggest that the greater the number of trials required to learn the first task and the higher the level of practice on the first task the more the warm-up effect on transfer of learning (Thune, 1951). Warm-up is related to learning-to-learn which also affects transfer of learning (Schwenn & Postman, 1967). Accordingly, it can be assumed that a low meaningfulness task should be related to the level of practice on the first task,

warm-up, and learning-to-learn. Consequently, a low meaningfulness or a difficult task should yield more practice effect, warm-up, and learning-to-learn than does a high meaningfulness or an easy task (Noble, 1961, p. 201; Postman, Keppel & Zacks, 1968).

Postulate 1:

> A prior learning task with low meaningfulness is more effective (facilitative) on a transfer task than is a prior learning task with high meaningfulness on the same transfer task.

Meaningfulness is an aspect of a learning task. A low meaningfulness prior task and a low meaningfulness transfer task may be considered as being similar to each other in terms of a similar level of meaningfulness. Likewise, a high meaningfulness prior task and a high meaningfulness transfer task may be viewed as similar to each other because each has a similar level of meaningfulness. Based on a review of the literature, McGeoch and Irion, (1960) have reported that there is usually less transfer between tasks of different types than between tasks of the same type. From their report and related evidence, the following postulate is derived:

Postulate 2:

> When a similar level of meaningfulness is maintained between a pretraining and a transfer task, a combination of the effects of such an arrangement results in learning performance which is superior to performance in a combination of the effects of dissimilar levels of meaningfulness between a pretraining and a transfer task (i.e. high meaningfulness pretraining task to high meaningfulness transfer task, plus low meaningfulness pretraining task to low meaningfulness transfer task is greater than high meaningfulness pretraining task to low meaningfulness transfer task, plus low meaningfulness pretraining task to high meaningfulness transfer task).

Hypotheses

From the above two postulates, the experimenter adopted the following hypotheses for the present study:

Hypothesis 1:

The amount of transfer from a low meaningfulness serial task to a high meaningfulness paired-associate task (L-H transfer condition) is significantly greater than the amount of transfer from a high meaningfulness serial task to a high meaningfulness PA task (H-H transfer condition).

Hypothesis 2:

The amount of transfer from a low meaningfulness serial task to a low meaningfulness PA task (L-L transfer condition) is significantly greater than the amount of transfer from a high meaningfulness serial task to a low meaningfulness PA task (H-L transfer condition).

Hypothesis 3:

The combination of the amounts of transfer in the H-H and L-L transfer conditions is significantly greater than the combination of the amounts of transfer in the H-L and L-H transfer conditions.

Hypothesis 4:

The combination of the amounts of transfer in the transfer conditions L-H and L-L is significantly greater than the combination of the amounts of transfer in H-H and H-L transfer conditions.

CHAPTER IV

RESEARCH DESIGN

Sample and Subjects

The Ss in this study were 42 boys and 42 girls who were randomly selected from two subject-pools of 46 boys and 48 girls enrolled in the senior opportunity classrooms of McKay Avenue Public School in Edmonton, Alberta. According to the cumulative records, including data supplied by physicians, psychologists, teachers and school counselors, the 94 Ss of the two subject-pools were free from significant emotional disturbances. In addition, the Ss did not have any history of epilepsy, speech impairment, nor apparent sensory disability (i.e., vision, hearing, brain injury) which might have impaired their suitability for the present study.

The following criteria of the Department of Education, Province of Alberta, are accepted as guidelines for the placement of children in opportunity classrooms of the Edmonton Public School Board. The candidate should:

a. Be of legal school age.

b. Have an intelligence quotient in the range 55 ± 5 to 75 ± 5 as measured on an individual intelligence test administered by or under the supervision of a Provincial Guidance Clinic, or a competent psychologist.

c. Have a record of poor achievement in the regular classroom.

d. Have had a medical examination to ascertain whether or not there are sensory defects, etc. (see Appendix F).

According to the cumulative records for the pupils, 79 Ss in this study had been recently assessed individually on intelligence tests such as Wechsler Intelligence Scale for Children (WISC), Wechsler Adult Intelligence Scale (WAIS), and Stanford Binet Intelligence Scale (SB). Only 4 Ss appeared to have been assessed by group intelligence tests such as Lorge-Thorndike Intelligence Test (LIT), Otis Quick-Scoring Mental Ability Tests (OQMAT), California Short-Form Tests of Mental Maturity, Primary (CSTMMP), and Detroit Advanced First-Grade Intelligence Test (DFIT). Clearly these Ss did not meet the selection criterion which requires that candidates for placement be assessed by an individual intelligence test. In fact, 22 Ss in this study did not meet the IQ selection criterion, because their IQs were not within the range of 55 ± 5 to 75 ± 5.

In summary, all Ss were drawn from senior opportunity rooms of the Edmonton Public School System and the great majority met the placement criteria enunciated by the Department of Education, Province of Alberta. It is worthy of note, however, that factors other than the scores on intelligence tests appear operative in decisions to place children in classrooms for the educable mentally retarded.

At the beginning of the experiment these Ss had a CA range of 15 years to 18 years and 9 months. The means, SD, and ranges of the CAs and IQs of the treatment groups are presented in Table 1. The individual IQ scores of the Ss are also available (see

Appendix D). One S was later excluded from the experiment because he could not learn both the serial and paired-associates tasks.

TABLE I

CAs and IQs OF THE TREATMENT GROUPS

Group	N	CA (mo.)			IQ		
		mean	range	SD	mean	range	SD
Ex. I-1	14	197.57	181-217	12.17	78.71	62-91	9.46
Ex. I-2	14	198.64	180-219	12.12	72.93	50-89	10.44
Ex. I-3	14	199.21	188-218	9.18	72.21	56-100	12.33
Ex.II-1	13	197.23	184-217	10.68	72.85	56-94	10.58
Ex.II-2	14	195.36	182-220	12.57	77.07	60-91	8.51
Ex.II-3	14	197.64	181-225	12.92	72.21	56-86	8.23
Ex. I-1 and II-1	27	197.41	181-217	11.27	75.89	56-94	10.30
Ex. I-2 and II-2	28	197.00	180-220	12.21	75.00	50-91	9.58
Ex. I-2 and II-1	27	197.96	180-219	11.23	72.89	50-94	10.30
Ex. I-1 and II-2	28	196.46	181-220	12.21	77.89	60-91	8.87

Experimental Design

Two experiments were included in this study. Experiment I was designed to examine: (1) the amounts and directions of transfer in the H-H and L-H transfer conditions as compared with learning in the control condition, and (2) the difference between the transfer in the H-H transfer condition and that in the L-H transfer condition. The design for this experiment is charted as follows:

	Serial Learning	Paired-associate Learning	
Experimental Group I (Ex. I-1)	H	H	N=14
Experimental Group 2 (Ex. I-2)	L	H	N=14
Control Group (Ex. I-3)	None	H	N=14

Experiment II was designed to examine: (1) the amounts and direction of transfer in the L-L and H-L transfer conditions as compared with the learning in control condition, and (2) the difference between the transfer in the L-L transfer condition and that in the H-L transfer condition. The design for this experiment is charted as follows:

	Serial Learning	Paired-associate Learning	
Experimental Group I (Ex. II-1)	L	L	N=13
Experimental Group 2 (Ex. II-2)	H	L	N=14
Control Group (Ex. II-3)	None	L	N=14

The designs of Experiment I and Experiment II were also used to compare: (1) the difference between the combination of transfer in the transfer conditions H-H and L-L and the combination of transfer in the transfer conditions L-H and H-L; and (2) the difference between the combination of transfer in the transfer conditions L-H and L-L and the combination of transfer in the transfer conditions H-H and H-L. These two designs are charted as follows:

	Serial Learning	Paired-associate Learning	
Group Ex. I-1	H	H	
and			N=27
Group Ex. II-1	L	L	
Group Ex. I-2	L	H	
and			N=28
Group Ex. II-2	H	L	

	Serial Learning	Paired-associate Learning	
Group Ex. I-2	L	H	
and			N=27
Group Ex. II-1	L	L	
Group Ex. I-1	H	H	
and			N=28
Group Ex. II-2	H	L	

Stimulus Materials and Apparatus

The materials used in this study were 12 low meaningfulness words and 12 high meaningfulness words randomly selected from Entwisle's study (1966). Six of the 12 low meaningfulness words were used to make the low meaningfulness serial task, and the other six words were used to make the low meaningfulness paired-associate task. Six of the 12 high meaningfulness words were used to make the high meaningfulness serial task, and the remaining six words were used to make the high meaningfulness paired-associate task. For the transfer tasks, numbers from 3 to 8 were used as stimuli and were randomly paired with the response words of the high meaningfulness and the low meaningfulness paired-associates task (see Appendix A).

Two automatic memory drums were used for the presentation of the tasks to the Ss. One memory drum was used to present the serial tasks; the other was used to present the paired-associates tasks.

Pilot Study

A pilot study was conducted outside the Edmonton Public Schools with 12 EMR boys and girls in an opportunity classroom at St. Basil School in the Edmonton Separate School System in order to perfect administration techniques and to ascertain the suitability of tasks for the adolescent EMR boys and girls. From the pilot study, the writer found that the low and high meaningfulness tasks, both of the serial and paired-associate tasks, were appropriate for adolescent EMR boys and girls.

Procedures

Twenty-one boys and 21 girls were randomly assigned to Experiment I, Group I from 42 boys and 42 girls. The remaining Ss were included in Experiment II. The Ss for Experiment I were randomly assigned to three subgroups of seven boys and seven girls each - Group Ex. I-1, Group Ex. I-2, and Group Ex. I-3. The Ss in Group Ex. I-1 were to learn first the high meaningfulness serial task and then the high meaningfulness paired-associate task. The Ss in Group Ex. I-2 were to learn the low meaningfulness serial task first and then the high meaningfulness paired-associate task. The Ss in Group Ex. I-3 were to learn the high meaningfulness paired-associate task only.

The 21 boys and 21 girls in Experiment II were also randomly assigned to the three subgroups of seven boys and seven girls each - Group Ex. II-1, Group Ex. II-2, and Group Ex. II-3. The Ss in Group Ex. II-1 were to learn first the low meaningfulness serial task and then the low meaningfulness paired-associate task. The Ss

in Group Ex. II-2 were to learn the high meaningfulness serial task first and then the low meaningfulness paired-associate task. The Ss in Group Ex. II-3 were to learn the low meaningfulness paired-associate task only.

Anticipation method was employed in the serial and paired-associate learning. One series of correct responses was the criterion measure for both serial and paired-associate learning. The serial task was presented at a rate of one stimulus per 3 seconds. The paired-associate stimuli was presented at a 5:5 second rate. The rest interval between serial learning and paired-associate learning was 2 minutes. Three different random orders were used to present the paired-associate task in order to reduce possibility of serial associations.

Statistical Analysis

The amount of transfer of learning from serial to paired-associate learning of each condition of Experiment I and Experiment II was measured by subtracting the mean number of trials to criterion in the paired-associate learning task of the control group from the mean number of trials to criterion in the same paired-associate learning task of each experimental group.

The t test (Ferguson, 1966) was used to: (1) test the significance of the amount and direction of transfer in each experimental condition as compared with the control condition of Experiment I and Experiment II, and (2) test the four hypotheses of this study. The correlation between IQ scores and paired-

associate learning scores was analyzed in order to investigate whether or not the treatment effect of this study was largely attributable to the IQ variable. The t test (Ferguson, 1966) was also employed to test the significance of the observed correlation coefficient.

CHAPTER V

RESULTS OF STUDY

Since the experimental and control groups did not always have comparable IQs, it was necessary to show that IQ did not correlate with performance in the learning tasks. An overall product-moment *r* was calculated between IQ and paired-associate learning scores for all subjects, and was found to be negligible, thus showing that differences due to treatment could not be merely attributed to the IQ variable (see Appendix E).

Table 2 presents mean number of trials to criterion and standard deviations in serial and paired-associate learning of the treatment groups. Table 3 shows mean number of trials to criterion and values of *t* in paired-associate learning among the treatment groups. Fig. 1 presents the amount of transfer of learning of each treatment group in Experiment I, and Fig. 2 shows the amount of transfer of learning of each treatment group in Experiment II. Fig. 3 presents the amount of transfer of learning of each of the four combined treatment groups.

Trials to learn the high meaningfulness paired-associate task of Group Ex. I-1 was 4.00 less than trials to learn the same high meaningfulness paired-associate task of Group Ex. I-3, the control group of Experiment I. The observed result shows a trend for positive transfer from high meaningfulness serial task to high meaningfulness paired-associate task, even though it was not

TABLE 2

MEAN NUMBER OF TRIALS TO CRITERION ($\bar{X}$) AND STANDARD DEVIATIONS (SDs) IN SERIAL LEARNING AND PAIRED-ASSOCIATE LEARNING OF THE TREATMENT GROUPS

Group	N	Serial Learning		Paired-associate Learning	
		$\bar{X}$	SD	$\bar{X}$	SD
Ex. I-1 (H-H)	14	6.71	1.68	10.93	6.43
Ex. I-2 (L-H)	14	11.43	4.22	16.36	8.24
Ex. I-3 (H)	14	--	--	14.93	6.53
Ex. II-1 (L-L)	13	12.62	6.21	18.92	7.22
Ex. II-2 (H-L)	14	9.07	3.83	11.29	8.27
Ex. II-3 (L)	14	--	--	15.29	8.96
Ex.I-1 & Ex.II-1 (H-H) & (L-L)	27	9.56	5.32	14.78	7.83
Ex.I-2 & Ex.II-2 (L-H) & (H-L)	28	10.25	4.14	13.82	8.50
Ex.I-2 & Ex.II-1 (L-H) & (L-L)	27	12.00	5.21	17.59	7.73
Ex.I-1 & Ex.II-2 (H-H) & (H-L)	28	7.89	3.14	11.11	7.27

TABLE 3

MEAN NUMBERS OF TRIALS TO CRITERION ($\bar{X}$) AND VALUES OF t IN PAIRED-ASSOCIATE LEARNING AMONG THE TREATMENT GROUPS

Group	$\bar{X}$	df	t	Probability
Ex. I-1	10.93	26	1.95	$.05 < p < .10$
Ex. I-2	16.36			
Ex. I-1	10.93	26	1.63	$.10 < p < .20$
Ex. I-3	14.93			
Ex. I-2	16.36	26	0.51	$p > .20$
Ex. I-3	14.93			
Ex. II-1	18.92	25	2.55*	$.01 < p < .02$
Ex. II-2	11.29			
Ex. II-1	18.92	25	1.15	$p > .20$
Ex. II-3	15.29			
Ex. II-2	11.29	26	1.23	$p > .20$
Ex. II-3	15.29			
Ex. I-1 & Ex.II-1	14.78	53	0.44	$p > .20$
Ex. I-2 & Ex.II-2	13.82			
Ex. I-2 & Ex.II-1	17.59	53	3.21**	$.001 < p < .01$
Ex. I-1 & Ex.II-2	11.11			

*significant at the .02 level
**significant at the .01 level

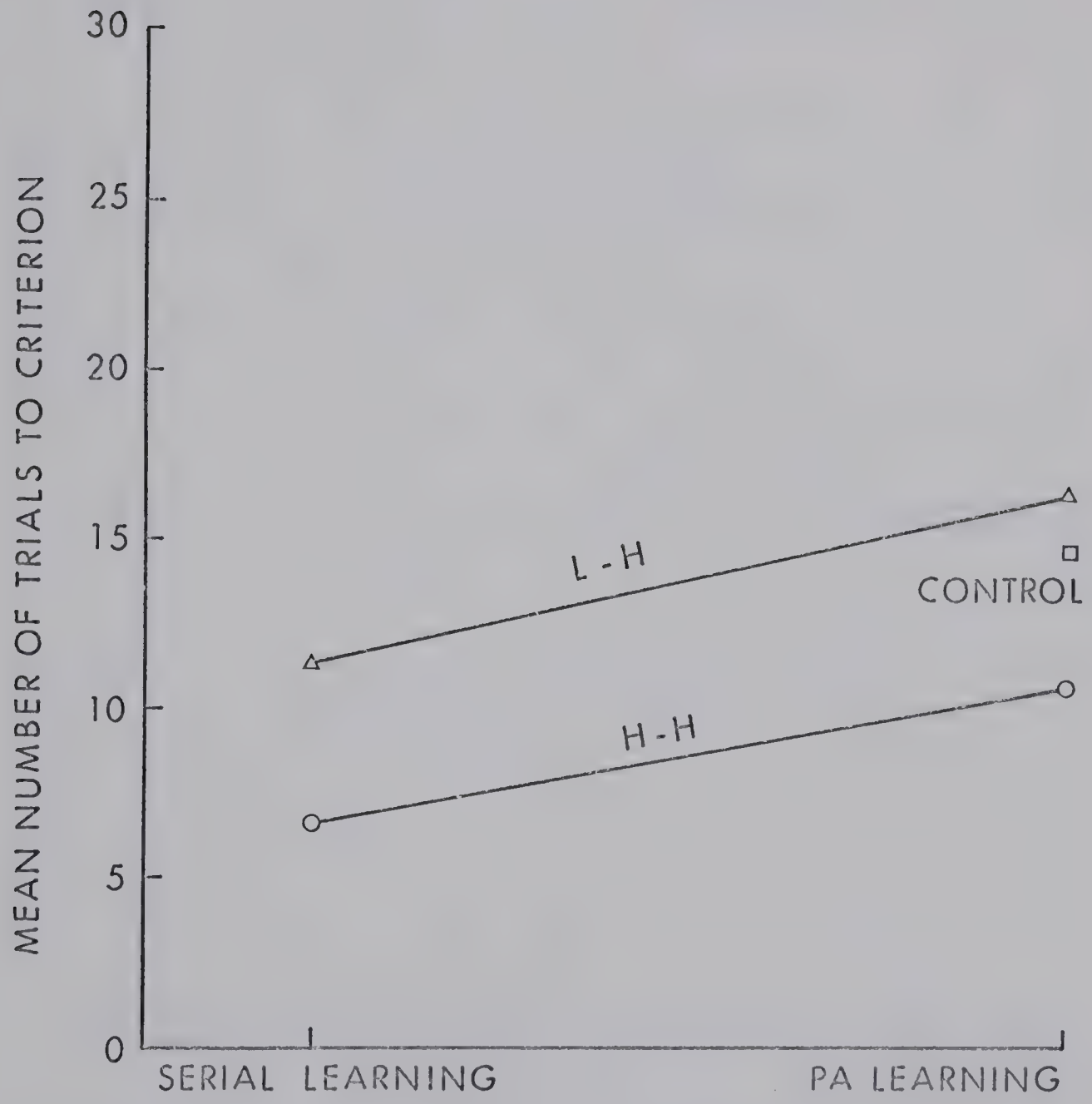

Fig. 1. Transfer of learning of each treatment group of Experiment 1

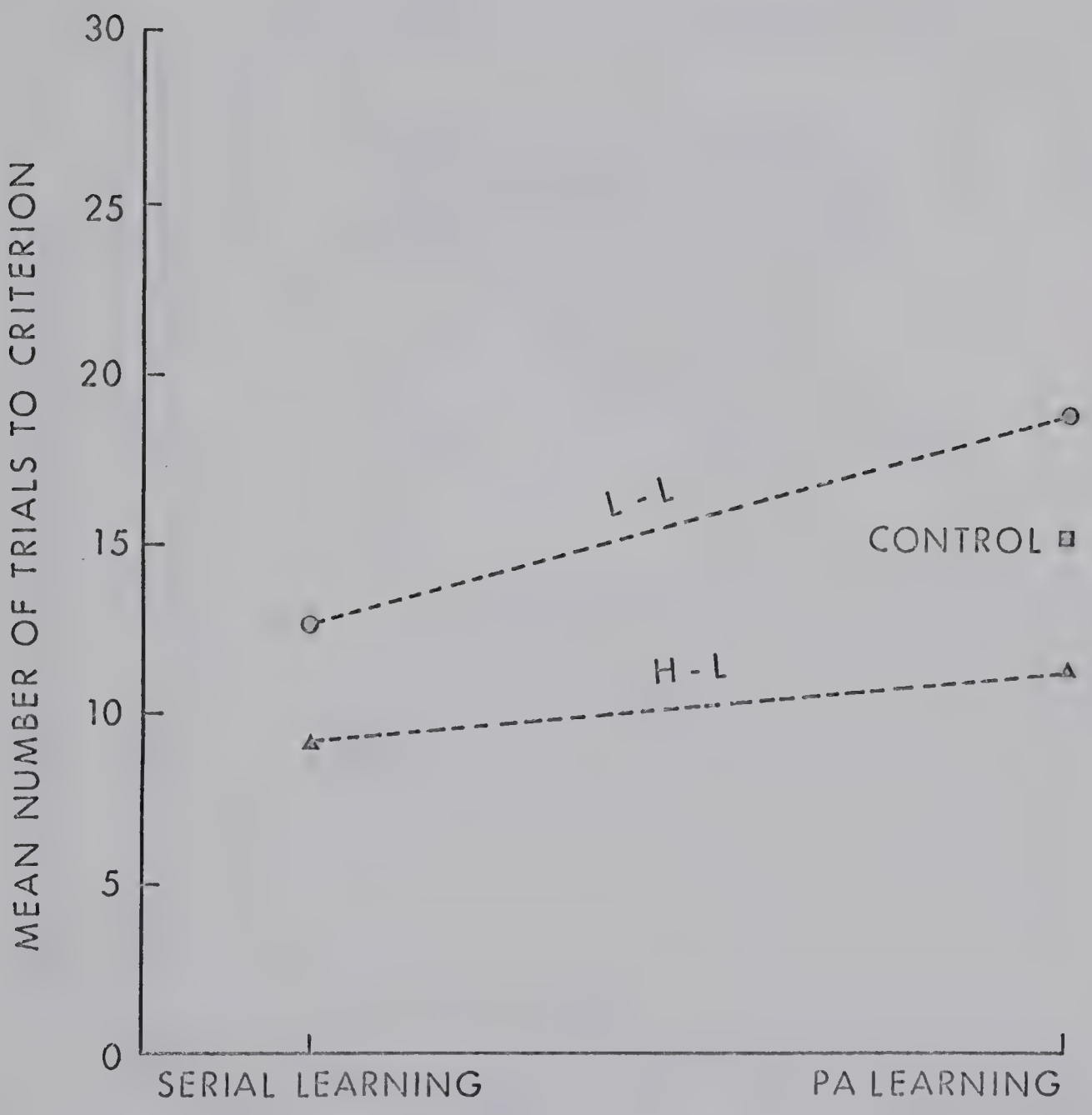

Fig. 2. Transfer of learning of each treatment group of Experiment II

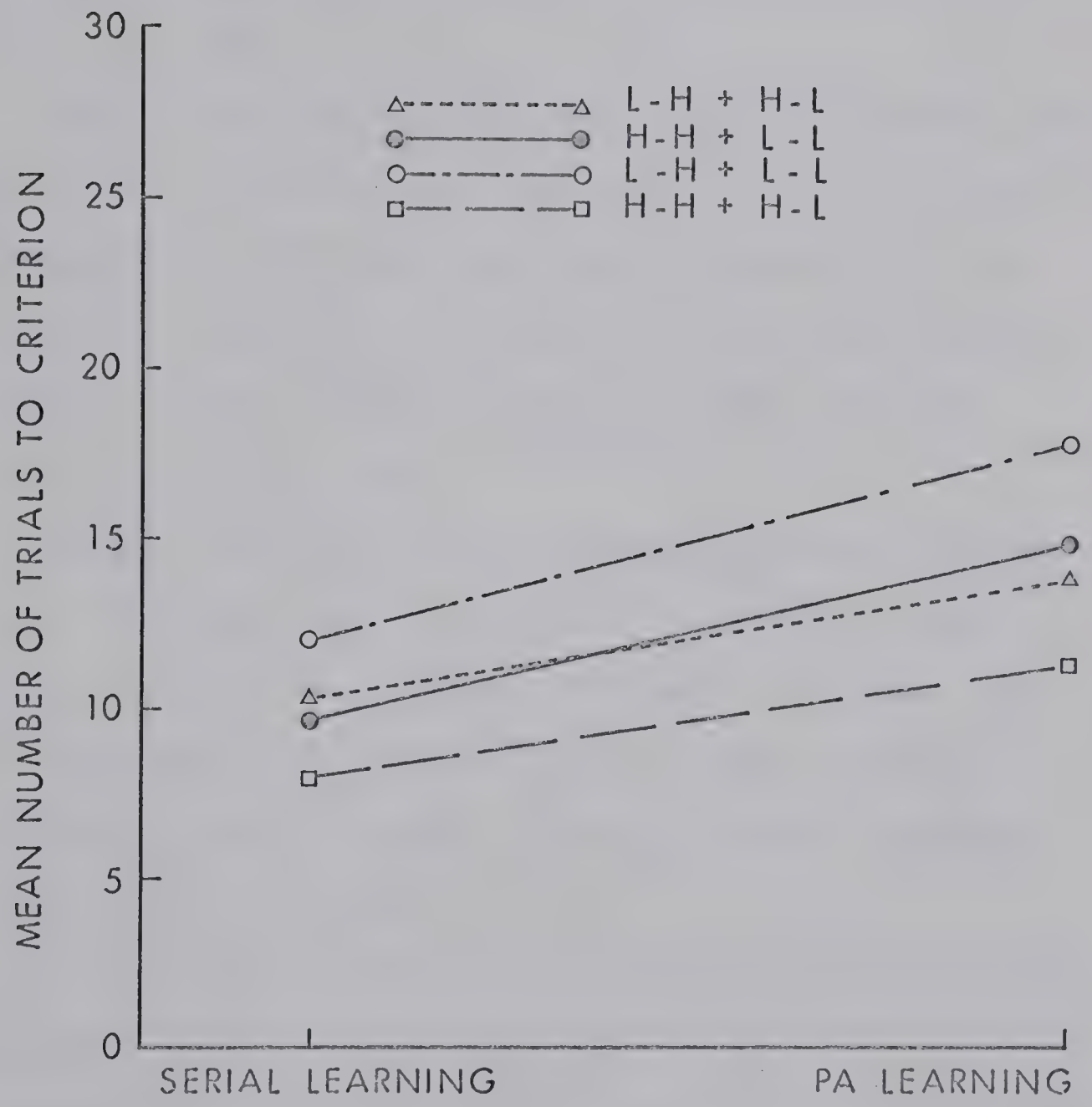

Fig. 3. Transfer of learning of each of the four combined treatment groups

significant (t = 1.63, df = 26, $p > .05$).

Trials to learn the high meaningfulness paired-associate task of Group Ex. I-2 was 1.43 greater than trials to learn the same high meaningfulness paired-associate task of Group Ex. I-3. The observed result indicates a tendency in the direction of negative transfer in the L-H transfer condition, but it was not significant (t = 0.51, df = 26, $p > .05$).

Trials to learn the low meaningfulness paired-associate task of Group Ex. II-1 was 3.63 greater than trials to learn the same low meaningfulness paired-associate task of Group Ex. II-3, the control group of Experiment II. The observed difference reveals the trend for negative transfer in the L-L transfer condition (t = 1.15, df = 25, $p > .05$).

Trials to learn the low meaningfulness paired-associate task of Group Ex. II-2 was 4.00 less than trials to learn the same low meaningfulness paired-associate task of Group Ex. II-3, the control group in Experiment II. The observed result shows a tendency in the direction of positive transfer in the H-L transfer condition (t = 1.23, df = 26, $p > .05$).

Trials to learn the high meaningfulness paired-associate task of Group Ex. I-1 was 5.43 less than trials to learn the same high meaningfulness paired-associate task of Group Ex. I-2. The observed difference revealed that there was a tendency toward greater transfer in the H-H transfer condition than in the L-H transfer condition. The difference approached significance (t = 1.95, df = 26, $p < .10$). However, the observed difference was in a contrary direction to the

first hypothesis, i.e., the amount of transfer in the L-H transfer condition is significantly greater than the amount of transfer in the H-H transfer condition.

Trials to learn the low meaningfulness paired-associate task of Group Ex. II-1 was 7.63 greater than trials to learn the same low meaningfulness paired-associate task of Group Ex. II-2, and the observed difference was significant ($t = 2.55$, $df = 25$, $p < .02$). The significant difference indicated that the transfer in the H-L transfer condition was significantly greater than the transfer in the L-L transfer condition, and that the observed result was not consistent with the prediction that the amount of transfer in the L-L transfer condition is significantly greater than the amount of transfer in the H-L transfer condition.

There was no significant difference between the combination of trials to learn the paired-associate tasks of Group Ex. I-1 and Group Ex. II-1 and the combination of trials to learn the paired-associate tasks of Groups Ex. I-2 and Ex. II-2 ($t = 0.44$, $df = 53$, $p > .05$). Accordingly, the observed result was not in agreement with the third hypothesis, i.e., the combination of transfer in the H-H and L-L transfer conditions is significantly greater than the combination of transfer in the L-H and H-L transfer conditions.

The combination of trials required to learn the paired-associate tasks of Groups Ex. I-2 and Ex. II-1 was 6.8 greater than the combination of trials required to learn the paired-associate tasks of Groups Ex. I-1 and Ex. II-2. The observed difference was

significant ($t = 3.21$, $df = 53$, $p < .01$), but it was not in agreement with the fourth hypothesis, i.e., the combination of transfer in the L-H and L-L transfer conditions is significantly greater than the combination of transfer in the H-H and H-L transfer conditions.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The non-significant positive and negative transfer, and non-significant difference between the transfer in the H-H transfer condition and that in the L-H transfer condition may have resulted from the fact that the number of Ss in each group was small, and wide range of intellectual ability of the Ss in this study.

Apparently, the analysis of data shows that the effect of learning a high meaningfulness prior task is more powerful on the transfer task than is the effect of learning a low meaningfulness prior task. The experimental group Ss in the H-L transfer condition required fewer trials to learn the transfer task than did the experimental group Ss in the L-L transfer condition. When combinations of treatments were made, the experimental groups which had learned the high meaningfulness prior tasks also required fewer trials to learn the transfer tasks than did the experimental groups who had learned the low meaningfulness prior tasks. It can be assumed that the prediction of low meaningfulness prior task training, in relationship with the practice, warm-up, and learning-to-learn, may not be true in the case of a study using the mentally retarded Ss. In learning the high meaningfulness prior task, the mentally retarded may have been encouraged, and may have developed a high level of motivation for the learning of a succeeding transfer task. In learning

the low meaningfulness or difficult prior task, the mentally retarded Ss required greater number of trials to reach the learning criterion. Consequently, the Ss would develop low generalized expectancy for success (Heber, 1957), and would give up trying or expecting to be successful. The Ss would then become primarily concerned with attempting to avoid failure (Moss, 1958), and, as a consequence, the performance of the Ss would deteriorate on the transfer task.

The results of this study are not in agreement with Postman, Keppel, and Zacks (1968) who hypothesized that the low meaningfulness training is more effective on the transfer task than is the high meaningfulness training. Some possible sources of explanation for this difference may be that: (1) this study employed mentally retarded Ss in each of six groups, but the study of Postman, Keppel, and Zacks (1968) used university undergraduates in each of eight groups; and (2) this study used the serial list as the prior task and the paired-associate task as the transfer task, but the two successive tasks in Postman, Keppel, and Zacks' study were the paired-associate tasks.

In addition, the results of this study are not consistent with the study of Young and Casey (1964) who predicted that practice effect resulting from prior serial task learning is an important factor influencing transfer from serial to paired-associate learning. Likewise, a possible difference between the two studies may have been related to the different types of Ss. The prediction of Young and Casey (1964) may have been true if the university undergraduates had

participated in the present study. However, the results of the present study are in accord with Smith's notion (1968) that, "When retarded youngsters are given an opportunity to solve and master easy problems prior to their being exposed to more difficult problems, the establishment of a learning set is effected more rapidly (p.45)."

The non-significant difference between the transfer in the H-H and L-L transfer conditions and in the L-H and H-L transfer conditions suggests that item similarity does not have any strong effect on transfer from serial to paired-associate learning.

Recommendations

From results yielded by this study, it appears that training on a high meaningfulness prior task is more effective on a succeeding task than is the training on a low meaningfulness prior task. In consequence, it is reasonable to suggest that the following considerations should be taken into account in dealing with the mentally retarded students:

1. Mentally retarded students should be first presented with high meaningfulness or easy materials so that high motivation or high generalized expectancy for success can be developed as preparation for learning subsequent materials. In developing daily lesson plans for the mentally retarded students, for example, the presentation of materials and the elements within each lesson unit should move from the simple to the complex (Smith, p. 265).

2. The teacher should be aware of significance of motivational factors.

3. The teacher or parent should make certain that the learning materials are sequential and programmed within the range of the child's competence.

4. Demonstration studies in natural classroom situations to ascertain the transfer effects of learning high and low meaningful tasks are indicated.

Finally, it is recommended that the criteria for placement of children in special classrooms for the educable mentally retarded (see Appendix F) should be more carefully observed and applied. Further research on the transfer effects of learning easy and difficult tasks on subsequent learning tasks at different levels of meaningfulness, using larger groups of more precisely classified mentally retarded subjects, is necessary.

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APPENDICES

APPENDIX A

SERIAL AND PAIRED-ASSOCIATE TASKS

High Meaningfulness Serial Task

MAN
BIRD
SIT
CLEAN
BLACK
LOUD

Low Meaningfulness Serial Task

SINCE
ON
MOTH
SWIFT
NET
UP

High Meaningfulness Paired-associate Task

5 - ADD
4 - HIGH
8 - HER
6 - DARK
7 - COLD
3 - TELL

Low Meaningfulness Paired-associate Task

5 - SLOW
3 - OFF
7 - SOUR
4 - SMOOTH
8 - ONCE
6 - MIX

A P P E N D I X B

INSTRUCTION FOR THE EXPERIMENT

Instruction for the Experiment

The experiment says, "I have two tasks for you to learn. They are not difficult to learn. These two tasks are like playing a game of guessing. It won't take you long. The first game is a list of six words. Shortly after the machine starts, you will see two little stars, and then the first word will appear in the window. As you see the stars, your job is to guess the first word, by saying it out loud, before it appears in the window. When you see the first word, you are to guess the second word. When you see the second word, you are to guess the third word. You do the same until you see the fifth word and then you are to guess the sixth word. The two little stars will tell you that the game is about to begin again."

After the experimenter has given the explanation to the subject, he presents a practice list of three words in order to acquaint the subject with the learning method of the serial task. When the experimenter is certain that the subject understands how to learn the serial task, he begins the presentation of the serial task by saying, "O.K. It's now your job to guess each word in the game." When the subject can anticipate every word of the serial task correctly, the experimenter tells the subject to rest for 2 minutes.

During the rest interval the experimenter has conversation with the subject and then says, "I have another game for you. Your job is to guess the word that goes with each number. When you see a number appear alone in the window, you are to guess the word that goes with that number. After you guess, you will see the number and the correct word in the window. Then you will know your guess is

right or wrong. The two little stars will tell you that the game is about to start again. When you can guess every word that goes with each number correctly, you will have won."

The experimenter, then, presents a practice list of two number word pairs in order to acquaint the subject with the method of learning the paired-associate task. When the experimenter is certain that the subject understands how to learn the paired-associate task, the experimenter begins the presentation of the paired-associate tasks by saying, "O.K. Let's see how well you can do." When the learning is over, the experimenter thanks the subject for coming to the experiment.

APPENDIX C

SERIAL AND PAIRED-ASSOCIATE LEARNING SCORES OF THE TREATMENT GROUPS

Serial Learning Scores of Group Ex. I-I

Subject	No. of Trials
1	4
2	7
3	6
4	9
5	9
6	9
7	6
8	6
9	5
10	5
11	8
12	5
13	7
14	8

Serial Learning Scores of Group Ex. 1-2

Subject	No. of Trials
1	11
2	8
3	8
4	13
5	9
6	10
7	10
8	6
9	11
10	19
11	13
12	8
13	21
14	13

Serial Learning Scores of Group Ex. II-I

Subject	No. of Trials
1	9
2	25
3	11
4	11
5	6
6	10
7	11
8	11
9	27
10	13
11	10
12	12
13	8

Serial Learning Scores of Group Ex. II-2

Subject	No. of Trials
1	15
2	9
3	16
4	7
5	9
6	8
7	5
8	5
9	15
10	5
11	7
12	9
13	11
14	6

Serial Learning Scores of Groups Ex. I-I and Ex. II-I

Subject	No. of Trials	Subject	No. of Trials
1	4	15	9
2	7	16	25
3	6	17	11
4	9	18	11
5	9	19	6
6	9	20	10
7	6	21	11
8	6	22	11
9	5	23	27
10	5	24	13
11	8	25	10
12	5	26	12
13	7	27	8
14	8		

Serial Learning Scores of Groups Ex. I-2 and Ex. II-2

Subject	No. of Trials	Subject	No. of Trials
1	11	15	15
2	8	16	9
3	8	17	16
4	13	18	7
5	9	19	9
6	10	20	8
7	10	21	5
8	6	22	5
9	11	23	15
10	19	24	5
11	13	25	7
12	8	26	9
13	21	27	11
14	13	28	6

Serial Learning Scores of Groups Ex. I-2 and Ex. II-I

Subject	No. of Trials	Subject	No. of Trials
1	11	15	9
2	8	16	25
3	8	17	11
4	13	18	11
5	9	19	6
6	10	20	10
7	10	21	11
8	6	22	11
9	11	23	27
10	19	24	13
11	13	25	10
12	8	26	12
13	21	27	8
14	13		

Serial Learning Scores of Groups Ex. I-1 and Ex. II-2

Subject	No. of Trials	Subject	No. of Trials
1	4	15	15
2	7	16	9
3	6	17	16
4	9	18	7
5	9	19	9
6	9	20	8
7	6	21	5
8	6	22	5
9	5	23	15
10	5	24	5
11	8	25	7
12	5	26	9
13	7	27	11
14	8	28	6

Paired-associate Learning Scores of Group Ex. I-I

Subject	No. of Trials
1	5
2	8
3	13
4	9
5	30
6	6
7	8
8	7
9	9
10	17
11	8
12	13
13	7
14	13

Paired-associate Learning Scores of Group Ex. I-2

Subject	No. of Trials
1	30
2	14
3	23
4	9
5	13
6	8
7	30
8	12
9	9
10	30
11	16
12	11
13	12
14	12

Paired-associate Learning Scores of Group Ex. 1-3

Subject	No. of Trials
1	17
2	9
3	14
4	13
5	8
6	22
7	28
8	9
9	21
10	8
11	11
12	15
13	24
14	10

Paired-associate Learning Scores of Group Ex. II-I

Subject	No. of Trials
1	11
2	30
3	10
4	20
5	9
6	19
7	20
8	20
9	30
10	24
11	14
12	13
13	26

Paired-associate Learning Scores of Group Ex. II-2

Subject	No. of Trials
1	30
2	6
3	10
4	8
5	30
6	7
7	8
8	14
9	5
10	8
11	6
12	11
13	9
14	6

Paired-associate Learning Scores of Group Ex. II-3

Subject	No. of Trials
1	9
2	15
3	8
4	12
5	10
6	14
7	5
8	8
9	15
10	30
11	21
12	30
13	30
14	7

Paired-associate Learning Scores of Groups Ex. I-I and Ex. II-I

Subject	No. of Trials	Subject	No. of Trials
1	5	15	11
2	8	16	30
3	13	17	10
4	9	18	20
5	30	19	9
6	6	20	19
7	8	21	20
8	7	22	20
9	9	23	30
10	17	24	24
11	8	25	14
12	13	26	13
13	7	27	26
14	13		

Paired-associate Learning Scores of Groups Ex. I-2 and Ex. II-2

Subject	No. of Trials	Subject	No. of Trials
1	30	15	30
2	14	16	6
3	23	17	10
4	9	18	8
5	13	19	30
6	8	20	7
7	30	21	8
8	12	22	14
9	9	23	5
10	30	24	8
11	16	25	6
12	11	26	11
13	12	27	9
14	12	28	6

Paired-associate Learning Scores of Groups Ex. I-2 and Ex. II-I

Subject	No. of Trials	Subject	No. of Trials
1	30	15	11
2	14	16	30
3	23	17	10
4	9	18	20
5	13	19	9
6	8	20	19
7	30	21	20
8	12	22	20
9	9	23	30
10	30	24	24
11	16	25	14
12	11	26	13
13	12	27	26
14	12		

Paired-associate Learning Scores of Groups Ex. I-1 and Ex. II-2

Subject	No. of Trials	Subject	No. of Trials
1	5	15	30
2	8	16	6
3	13	17	10
4	9	18	8
5	30	19	30
6	6	20	7
7	8	21	8
8	7	22	14
9	9	23	5
10	17	24	8
11	8	25	6
12	13	26	11
13	7	27	9
14	13	28	6

A P P E N D I X D

INDIVIDUAL IQ SCORES OF THE TREATMENT GROUPS

Individual IQ Scores of Group Ex. I-I

Subject	IQ	Test Used	Date
1	90	WAIS	Dec. 13, 1968
2	71	WISC	Jan. 22, 1969
3	88	WISC	1966
4	81	WAIS	Dec. 13, 1968
5	87	WISC	Jan. 20, 1969
6	66	WISC	1963
7	91	WISC	Jan. 20, 1969
8	70	WISC	May, 1961
9	85	WISC	Jan. 5, 1969
10	62	SB	Sept. 1959
11	72	WISC	1967
12	74	WISC	1962
13	80	WISC	Jan. 1965
14	85	WISC	Feb. 3, 1969

Individual IQ Scores of Group Ex. 1-2

Subject	IQ	Test Used	Date
1	73	WAIS	Dec. 13, 1968
2	65	WISC	Dec. 13, 1966
3	75	WISC	Feb. 1966
4	75	WISC	1965
5	72	WISC	Jan. 22, 1969
6	50	WISC	Dec. 1966
7	89	WISC	Dec. 1966
8	80	WISC	Jan. 27, 1969
9	80	WISC	Mar. 1965
10	70	OQMAT	April, 1963
11	85	WAIS	Dec. 13, 1968
12	64	WISC	April, 1967
13	61	WISC	Feb. 3, 1969
14	82	WISC	

Individual IQ Scores of Group Ex. 1-3

Subject	IQ	Test Used	Date
1	80	WISC	Jan. 22, 1969
2	65	WISC	Dec. 1966
3	67	WISC	Sept. 1967
4	78	WISC	Feb. 11, 1962
5	77	WAIS	Jan. 17, 1969
6	72	WISC	Jan. 20, 1969
7	91	WISC	Mar. 1965
8	72	WISC	May, 1966
9	59	WAIS	Jan. 17, 1969
10	68	WISC	Dec. 12, 1966
11	100	WISC	Jan. 20, 1969
12	56	WAIS	Dec. 11, 1968
13	67	WISC	1961
14	59	WISC	Jan. 20, 1969

Individual IQ Scores of Group Ex. II-I

Subject	IQ	Test Used	Date
1	76	SB	Mar. 1960
2	64	WISC	1963
3	58	WISC	Dec. 1965
4	70	WAIS	Dec. 11, 1968
5	94	WAIS	Jan. 15, 1969
6	84	WAIS	Dec. 12, 1968
7	76	SB	1960
8	56	WISC	Dec. 1966
9	82	WAIS	Dec. 13, 1968
10	77	WISC	Oct. 1962
11	69	WISC	Sept. 1963
12	75	WISC	April, 1961
13	66	WISC	Jan. 20, 1969

Individual IQ Scores of Group Ex. II-2

Subject	IQ	Test Used	Date
1	60	WISC	Jan. 20, 1969
2	80	WISC	Dec. 4, 1968
3	76	WAIS	Jan. 15, 1969
4	72	WISC	April, 1961
5	91	WISC	Jan. 22, 1969
6	80	WISC	Jan. 20, 1969
7	84	CSTMMP	May, 1960
8	72	WISC	Jan. 20, 1969
9	64	WISC	1961
10	77	WISC	Jan. 17, 1969
11	72	WISC	Jan. 20, 1969
12	84	WAIS	Dec. 13, 1968
13	86	WAIS	Jan. 15, 1969
14	81	WAIS	Jan. 17, 1969

Individual IQ Scores of Group Ex. II-3

Subject	IQ	Test Used	Date
1	80	WISC	Mar. 1965
2	76	WAIS	Dec. 11, 1968
3	75	WISC	1961
4	72	WISC	Mar. 1964
5	56	SB	Mar. 1959
6	83	DFIT	Mar. 1961
7	72	WISC	May, 1961
8	72	WISC	1965
9	75	WISC	Jan. 22, 1969
10	70	WISC	Dec. 1966
11	61	WISC	Jan. 22, 1969
12	86	LIT	June, 1964
13	63	WAIS	Jan. 15, 1969
14	70	WISC	May, 1962

Individual IQ Scores of Groups Ex. I-I and Ex. II-I

Subject	IQ	Subject	IQ
1	90	15	76
2	71	16	64
3	88	17	58
4	81	18	70
5	87	19	94
6	66	20	84
7	91	21	76
8	70	22	56
9	85	23	82
10	62	24	77
11	72	25	69
12	74	26	75
13	80	27	66
14	85		

Individual IQ Scores of Groups Ex. I-2 and Ex. II-2

Subject	IQ	Subject	IQ
1	73	15	60
2	65	16	80
3	75	17	76
4	75	18	72
5	72	19	91
6	50	20	80
7	89	21	84
8	80	22	72
9	80	23	64
10	70	24	77
11	85	25	72
12	64	26	84
13	61	27	86
14	82	28	81

Individual IQ Scores of Groups Ex. I-2 and Ex. II-1

Subject	IQ	Subject	IQ
1	73	15	76
2	65	16	64
3	75	17	58
4	75	18	70
5	72	19	94
6	50	20	84
7	89	21	76
8	80	22	56
9	80	23	82
10	70	24	77
11	85	25	69
12	64	26	75
13	61	27	66
14	82		

Individual IQ Scores of Groups Ex. I-1 and Ex. II-2

Subject	IQ	Subject	IQ
1	90	15	60
2	71	16	80
3	88	17	76
4	81	18	72
5	87	19	91
6	66	20	80
7	91	21	84
8	70	22	72
9	85	23	64
10	62	24	77
11	72	25	72
12	74	26	84
13	80	27	86
14	85	28	81

APPENDIX E

CORRELATION BETWEEN IQ AND PAIRED-ASSOCIATE LEARNING SCORES

Correlation between IQ (X) and Paired-associate Learning Scores (Y)

Subject	X	Y	X^2	Y^2	XY
1	90	5	8100	25	450
2	71	8	5041	64	568
3	88	13	7744	169	1144
4	81	9	6561	81	729
5	87	30	7569	900	2610
6	66	6	4356	36	396
7	91	8	8281	64	728
8	70	7	4900	49	490
9	85	9	7225	81	765
10	62	17	3844	289	1054
11	72	8	5184	64	576
12	74	13	5476	169	962
13	80	7	6400	49	560
14	85	13	7225	169	1105
15	73	30	5329	900	2190
16	65	14	4225	196	910
17	75	23	5625	529	1725
18	75	9	5625	81	675
19	72	13	5184	169	936
20	50	8	2500	64	400
21	89	30	7921	900	2670
22	80	12	6400	144	960
23	80	9	6400	81	720
24	70	30	4900	900	2100
25	85	16	7225	256	1360
26	64	11	4096	121	704
27	61	12	3721	144	732
28	82	12	6724	144	984
29	80	17	6400	289	1360
30	65	9	4225	81	585
31	67	14	4489	196	938
32	78	13	6084	169	1014
33	77	8	5929	64	616
34	72	22	5184	484	1584
35	91	28	8281	784	2548
36	72	9	5184	81	648
37	59	21	3481	441	1239
38	68	8	4624	64	544
39	100	11	10,000	121	1100
40	56	15	3136	225	840
41	67	24	4489	576	1608
42	59	10	3481	100	590
43	76	11	5776	121	836
44	64	30	4096	900	1920
45	58	10	3364	100	580

Subject	X	Y	X^2	Y^2	XY
46	70	20	4900	400	1400
47	94	9	8836	81	846
48	84	19	7056	361	1596
49	76	20	5776	400	1520
50	56	20	3136	400	1120
51	82	30	6724	900	2460
52	77	24	5929	576	1848
53	69	14	4761	196	966
54	75	13	5625	169	975
55	66	26	4356	676	1716
56	60	30	3600	900	1800
57	80	6	6400	36	480
58	76	10	5776	100	760
59	72	8	5184	64	576
60	91	30	8281	900	2730
61	80	7	6400	49	560
62	84	8	7056	64	672
63	72	14	5184	196	1008
64	64	5	4096	25	320
65	77	8	5929	64	616
66	72	6	5184	36	432
67	84	11	7056	121	924
68	86	9	7396	81	774
69	81	6	6561	36	486
70	80	9	6400	81	720
71	76	15	5776	225	1140
72	75	8	5625	64	600
73	72	12	5184	144	864
74	56	10	3136	100	560
75	83	14	6889	196	1162
76	72	5	5184	25	360
77	72	8	5184	64	576
78	75	15	5625	225	1125
79	70	30	4900	900	2100
80	61	21	3721	441	1281
81	86	30	7396	900	2580
82	63	30	3969	900	1890
83	70	7	4900	49	490
	6171	1209	467095	22779	89786
	ΣX	ΣY	ΣX^2	ΣY^2	ΣXY

$$r_{XY} = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

$$= \frac{83 \times 89786 - 6171 \times 1209}{\sqrt{[83 \times 467095 - (6171)^2\ ]\ [83 \times 22779 - (1209)^2\ ]}}$$

$$= -0.02$$

$$t = r \sqrt{\frac{N - 2}{1 - r^2}}$$

$$= 0.02 \sqrt{\frac{83 - 2}{1 - (0.02)^2}}$$

$$= 0.18 \quad ; \quad df = 81$$

(r_{XY} is not significant at the .05 level)

APPENDIX F

CRITERIA FOR CLASSES FOR EDUCABLE MENTALLY HANDICAPPED CHILDREN

CRITERIA FOR CLASSES FOR EDUCABLE MENTALLY HANDICAPPED CHILDREN

A. Admission Procedures

1. Committee on Admissions:

A committee on admissions should be established, to consist of at least three persons, one of whom should be the Superintendent or a person appointed by him to act in his place. The other members may include the school principal, the special class teacher, school guidance personnel, a member of the Provincial Guidance Clinic or school psychological service. The committee will assist in initial screening and will advise in special-class placement, but responsibility for placement will rest with the Superintendent.

2. Eligibility:

Before any child is admitted to a special class for educable mentally handicapped children, he or she should:

(a) be of legal school age.
(b) have an intelligence quotient in the range 55 ± 5 to 75 ± 5 as measured on an individual intelligence test administered by or under the supervision of a Provincial Guidance Clinic or a competent psychologist.
(c) have a record of poor achivement in the regular classroom.
(d) have had a medical examination to ascertain whether or not there are sensory defects, etc.

(NOTE: A copy of the psychologist's report, as well as other pertinent reports and recommendations, should be kept in the child's cumulative folder.)

3. Parental Approval:

In no case should a pupil be assigned to a special class without the approval of the parents or guardian following a careful explanation of the nature of the special class and the meaning of special class placement.

B. Periodic Review of Placements

At the end of each year, careful consideration should be given to the question of whether or not the child should remain in the special class. A periodic reassessment by a competent psychologist is desirable.

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C. Accommodation

The special class should be accommodated if at all possible in a classroom of standard size and should preferably be located in buildings with children of comparable chronological age.

D. Class Enrolment

The enrolment of the special class for educable mentally handicapped children should be between ten and sixteen students. The range in chronological ages in the class should be a consideration in determining enrolment: the greater the chronological age range is, the lower the enrolment should be.

E. Teacher

The teacher of the special class should:

(a) hold a valid teaching certificate.
(b) have had successful experience in the regular classroom, particularly at the elementary level.
(c) have a genuine interest in teaching educable mentally handicapped children.
(d) if possible have taken university courses related to the education of educable mentally handicapped children.

F. Application for Approval to Operate the Class

NOTE: Application must be made each year, preferably early in the school year or prior to the commencement of the fall term, on the application form provided. No special class can be considered for special grants under Section 2 of the Grants Regulations until the application has been received.

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